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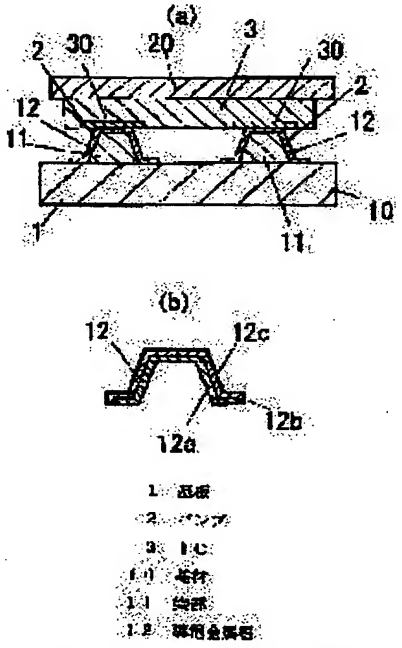
(54) BOARD FOR MOUNTING IC, ITS MANUFACTURING METHOD AND METHOD FOR MOUNTING IC THEREON

(57)Abstract:
PROBLEM TO BE SOLVED: To enable simple mounting of an IC with high reliability.
SOLUTION: A method for manufacturing a board for mounting the IC comprises the steps of covering the surface of a protrusion 11 provided on a surface of a base 10 with a conductive metal layer 12 which is a circuit pattern to form a bump 2 of an IC-mounting terminal. The protrusion 11 is formed of a material more flexible than the base 10. Even the smallest applied pressure necessary at the mounting time of the IC 3 absorbs at least dispersion in the heights of the bumps 2, to surely connect the bumps.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] The substrate for IC mounting characterized by forming the above-mentioned projected part with the ingredient softer than a base material while covering the projected part front face prepared on the surface of the base material in the conductive metal layer used as a circuit pattern and forming the bump who is a terminal area for IC mounting.
[Claim 2] A projected part is a substrate for IC mounting according to claim 1 characterized by being formed as another member to a base material, and being inserted in a base material.
[Claim 3] The substrate for IC mounting characterized by having prepared opening which exposes a projected part side face for a projected part front face in a wrap electric conduction metal layer while covering the projected part front face prepared on the surface of the base material in the conductive metal layer used as a circuit pattern and forming the bump who is a terminal area for IC mounting.
[Claim 4] Opening is a substrate for IC mounting according to claim 3 characterized by being formed as two or more flutings.
[Claim 5] Opening is a substrate for IC mounting according to claim 3 characterized by being a mesh-like thing.
[Claim 6] Opening is a substrate for IC mounting given in one term of claims 3-5 characterized by making a symmetry configuration to the peripheral surface of a projected part, and being formed in it.
[Claim 7] The projected part covered in the electric conduction metal layer while covering the projected part front face prepared on the surface of the base material in the conductive metal layer used as a circuit pattern and forming the bump who is a terminal area for IC mounting is a substrate for IC mounting characterized by vacating the hole for the side face.
[Claim 8] A hole is a substrate for IC mounting according to claim 7 characterized by being formed in the symmetry to the center line of a projected part.
[Claim 9] The substrate for IC mounting characterized by making the lobe which floated from the base material front face of this electric conduction metal layer while forming the conductive metal layer which serves as a circuit pattern on the surface of a base material into the bump who is a terminal area for IC mounting.
[Claim 10] The substrate for IC mounting characterized by forming the stoma in the part which has covered the apical surface of the above-mentioned projected part in an electric conduction metal layer while covering the projected part front face made from solder prepared on the surface of the base material in the conductive metal layer used as a circuit pattern and forming the bump who is IC mounting terminal area.
[Claim 11] The substrate for IC mounting according to claim 10 characterized by forming the slot which follows a stoma in the front face of the part which has covered the apical surface of the projected part in an electric conduction metal layer.
[Claim 12] The manufacture approach of the substrate for IC mounting characterized by forming the conductive metal layer which constitutes a circuit pattern on the surface of a base material, and forming the projected part as a bump who is a terminal area for IC mounting by attracting a part of conductive metal layer subsequently, and floating from a base material front face.
[Claim 13] The manufacture approach of the substrate for IC mounting characterized by forming the conductive metal layer which constitutes a circuit pattern on the surface of a base material, and

forming the projected part as a bump who is a terminal area for IC mounting by pushing up from a rear-face side and floating from a base material front face by the bar which it let pass to the hole which, subsequently to a base material, prepared the -1 section of a conductive metal layer.
[Claim 14] The manufacture approach of the substrate for IC mounting characterized by forming the projected part as a bump who is a terminal area for IC mounting by covering the front face of this projected part with the electric conduction metal layer used as a circuit pattern , carrying out melting of the above-mentioned low-melt point point ingredient with heating subsequently , and sucking out after preparing the projected part which consists of a low-melt point point ingredient on the surface of a base material .
[Claim 15] While covering the projected part front face made from solder prepared on the surface of the base material in the conductive metal layer used as a circuit pattern and forming the bump who is a terminal area for IC mounting As opposed to the substrate for IC mounting which forms the stoma in the part which has covered the apical surface of the above-mentioned projected part in an electric conduction metal layer The mounting approach of IC to the substrate for IC mounting characterized by extruding besides an electric conduction metal layer from a stoma while carrying out melting of the above-mentioned solder by carrying IC on a bump and carrying out heating pressurization, and joining an electric conduction metal layer and the terminal area of IC with this solder.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the substrate for IC mounting for mounting IC directly.
[0002]
[Description of the Prior Art] It considers as a bump by preparing a projected part in the base material front face of a substrate at JP,63-220533,A, and forming an electric conduction metal layer in this projected part front face as a substrate for mounting of IC, and what joins the terminal area of IC is shown to the above-mentioned bump by carrying and heating IC through conductive paste by this bump.
[0003] Moreover, considering as the bump who is a terminal area for IC mounting by fabricating a projected part to coincidence at the time of shaping of the solid shaping circuit board (MID substrate) which becomes the Patent Publication Heisei No. 511873 [nine to] official report from polymer resin, and forming in a projected part front face the conductive metal layer which constitutes a circuit pattern is indicated.
[0004] Although mounting of IC is possible for the substrate for IC mounting equipped with the bump formed as mentioned above even if it does not prepare a solder bump in the IC side, if a bump's height has not gathered, it will invite a faulty connection. On the other hand, the projected part on a substrate is the effect of the imprint nature from the dimensional accuracy metallurgy mold of metal mold to mold goods etc., in each bump's top-face height, dispersion in divisor mum arises upwards, and about 10-micrometer dispersion will produce it in the curvature after shaping of a substrate etc.
[0005] At this time, if the welding pressure at the time of IC mounting is used, the curvature of a substrate is reformable, if it has the composition that moreover the bump herself has elasticity, the difference in height can also be absorbed and a faulty connection's generating can be reduced. In the case of the solid shaping circuit board which consists of the above-mentioned polymer resin especially, a projected part can be formed in coincidence upwards at the time of shaping of a substrate, and since the projected part made of polymer resin has elasticity, it is convenient also in this point.
[0006]
[Problem(s) to be Solved by the Invention] However, other terminals will be joined by the welding pressure more than proper, if a possibility that the burden of IC or a substrate may become large too much, and damage may arise since the total welding pressure serves as a quite big value if the number of terminals of IC to which high integration progresses is dozens - a-100 number and it is going to apply the force to the bump of the number corresponding to this through IC at coincidence is upwards and it is going to apply welding pressure to a terminal with inadequate welding pressure. And it is easy to be rash in degradation by a thermal effect etc. at the time of long-term use, and becomes easy to produce the damage on a crack etc., and a problem arises in electrical connection dependability.
[0007] When necessary elasticity is given to the projected part with which a base material is equipped by forming a base material with an ingredient with such a property, it becomes impossible of course, to satisfy the property for which the base material itself is asked, although the difference

of the pressure the bump from whom height is different is under can be made small while the total welding pressure can be made small because it should be extremely rich in elasticity in each bump.
[0008] Moreover, even if the projected part under the conductive metal layer in a bump is what was rich in elasticity enough, when a conductive metal layer consists of three layers, a copper layer, a nickel layer, and a gold layer, the electric conduction metal layer is quite hard by existence of a nickel layer, and the elasticity which a projected part has cannot be harnessed.
[0009] This invention is made in view of such a point, and the place made into that purpose is to offer the manufacture approach of the substrate for IC mounting which can perform IC mounting on the basis of simple and high dependability, and this substrate for IC mounting, and the IC mounting approach to the substrate for IC mounting which can mount IC to this substrate for IC mounting simple.
[0010]
[Means for Solving the Problem] The substrate for IC mounting which carries out a deer and is applied to this invention has the 1st description to form the above-mentioned projected part with the ingredient softer than a base material while it covers the projected part front face prepared on the surface of the base material in the conductive metal layer used as a circuit pattern and forms the bump who is a terminal area for IC mounting.
[0011] In this case, the above-mentioned projected part can use suitably what was formed as another member to the base material, and was inserted in the base material.
[0012] Moreover, the substrate for IC mounting concerning this invention has the 2nd description to have prepared opening which exposes a projected part side face for a projected part front face in a wrap electric conduction metal layer while it covers the projected part front face prepared on the surface of the base material in the conductive metal layer used as a circuit pattern and forms the bump who is a terminal area for IC mounting.
[0013] Although what was formed as two or more flutings, and a mesh-like thing are suitable for opening in here, as for opening, in the case of which, it is desirable to make and form a symmetry configuration in the peripheral surface of a projected part.
[0014] While the substrate for IC mounting furthermore applied to this invention covers the projected part front face prepared on the surface of the base material in the conductive metal layer used as a circuit pattern and forming the bump who is a terminal area for IC mounting, the projected part covered in the electric conduction metal layer has the 3rd description for the hole to be vacated for the side face.
[0015] As for the hole in this case, it is desirable to form in the symmetry to the center line of a projected part.
[0016] Moreover, the substrate for IC mounting concerning this invention has the 4th description to make the lobe which floated from the base material front face of this electric conduction metal layer into the bump who is a terminal area for IC mounting while forming the conductive metal layer which serves as a circuit pattern on the surface of a base material.
[0017] Moreover, the substrate for IC mounting concerning this invention has the 5th description to form the stoma in the part which has covered the apical surface of the above-mentioned projected part in an electric conduction metal layer while it covers the projected part front face made from solder prepared on the surface of the base material in the conductive metal layer used as a circuit pattern and forms the bump who is a terminal area for IC mounting.
[0018] In this case, it is good to form the slot which follows a stoma in the front face of the part which has covered the apical surface of the projected part in an electric conduction metal layer.
[0019] and as the manufacture approach of the substrate for IC mounting equipped with the 4th description of the above Form the conductive metal layer which constitutes a circuit pattern on the surface of a base material, and form the projected part as a bump who is a terminal area for IC mounting by attracting a part of conductive metal layer subsequently, and floating from a base material front face, or Form a conductive metal layer on the surface of a base material, and form the projected part as a bump by pushing up from a rear-face side and floating from a base material front face by the bar which it let pass to the hole which, subsequently to a base material, prepared a part of conductive metal layer, or After preparing the projected part which furthermore consists of a low-melt point point ingredient on the surface of a base material, it is desirable to form the projected part

as a bump by covering the front face of this projected part with an electric conduction metal layer, carrying out melting of the above-mentioned low-melt point point ingredient with heating subsequently, and sucking out.
[0020] Moreover, it is good to extrude besides an electric conduction metal layer from a stoma, while carrying out melting of the above-mentioned solder by carrying IC on a bump and carrying out heating pressurization in mounting of IC to the substrate for IC mounting equipped with the 5th description of the above, and to join an electric conduction metal layer and the terminal area of IC with this solder.
[0021]
[Embodiment of the Invention] If this invention is explained in full detail based on an example of the gestalt of operation below, drawing 1 will cover the front face of a projected part 11 with the electric conduction metal layer 12 which constitutes the circuit pattern, and will form the bump 2 who is the terminal area for mounting of IC while it shows the outline configuration of the substrate 1 for IC mounting concerning this invention and has formed the projected part 11 of plurality (large number) in the front face of a base material 10. 20 in drawing is a fixture for the pressurization at the time of IC mounting.
[0022] Although the base material 10 in here is a plate-like thing and drawing shows it, what is formed as the solid shaping circuit board (MID substrate) can be suitably used for it. In addition, as for the projected part 11, width of face is formed because the electric conduction metal layer 12 from which about 100 micrometers and height are about 100 micrometers, are formed with plating, and constitute the circuit pattern gives about 5-10 micrometers nickel-plating 12b [about 5-10 micrometers] of thickness on copper-plating 12a of thickness and gives gilding 12c of 0.3-0.5-micrometer thickness extent on this further.
[0023] And it is formed with an ingredient which is different in the above-mentioned base material 10 and a projected part 11, and is formed with the soft ingredient with which the projected part 11 was rich in elasticity from the base material 10. If the case of the solid shaping circuit board is taken for an example, a base material 10 is poly phthalamide resin (elastic-modulus 5-10GPa), and the projected part 11 was formed with the fluororesin (elastic-modulus 0.1-1GPa), for example, it has formed the projected part 11 on the base material 10 with 2 color shaping (2 times shaping). At this time, two or more projected parts 11 do not need to be independent separately, and may form the connection layer which connects between projected parts 11 on the front face of a base material 10 with the same ingredient as a projected part 11.
[0024] Moreover, as shown in drawing 2 , after inserting in a base material 10 after fabricating a projected part 11 as another components in a base material 10 and attaching, you may make it form the electric conduction metal layer 12. Immobilization in the base material 10 of a projected part 11 is performed by press fit, adhesion, both concomitant use, etc. Also in this case, it is desirable to form the projected part block which fabricated two or more projected parts 11 to one, to insert this projected part block in a base material 10, and to fix.
[0025] Anyway, as for a projected part 11, in mounting IC3 by putting the terminal area 30 of IC3 on a bump 2, and connecting with her, since it forms with the ingredient softer than a base material 10, since a bump 2 does elastic deformation of the base material 10 to it being hard easily by pressurization and it absorbs dispersion in height, an excessive load does not require it for IC3.
[0026] In addition, as shown in drawing 3 , after applying under-filling 4 on a substrate 1 in mounting of IC3, Mounting by the heating pressurization of IC3 and hardening of the under-filling 4 by this heating are performed. By acquiring the fixed force which resisted the resiliency of a projected part 11 by under-filling 4, and also adding a supersonic wave to a bump 2 from the IC3 side, where the terminal area 30 of IC3 is carried Metal junction of the gold of the maximum upper layer and the aluminum of the terminal area 30 of IC3 in a bump's 2 electric conduction metal layer 12 is carried out, and under-filling 4 is slushed between IC3 and a substrate 1 next, and you may make it make it harden.
[0027] Other examples are shown in drawing 4 . This forms opening 13 in the part located in the side face of a projected part 11 among the electric conduction metal layers 12 which have covered the front face of a projected part 11, and exposes projected part 11 side face into it. In order that existence of this opening 13 may reduce greatly the rigidity of the electric conduction metal layer 12

in the direction which compresses a bump 2, a bump 2 will deform by the low load at the time of mounting of IC3, and absorption of dispersion in height will be made.
[0028] If make opening 13 into the thing of two or more fluting molds located in a line at equal intervals like shown in drawing 5 besides a rectangle-like aperture type, or it is made into a mesh configuration as shown in drawing 6 , or plurality is prepared in the position of symmetry as further shown in drawing 7 , since the bump 2 at the time of mounting of IC2 deforms with equally or sufficient balance, it will not arise [a crack etc.] in the electric conduction metal layer 12. In this case, even if a base material 10 and another ingredient do not have a soft projected part 11, necessary elasticity can be acquired as a bump 2.
[0029] The above-mentioned opening 13 is formed as follows. Namely, after forming a copper thin film in the front face of a base material 10 by the copper sputtering method, By separating a part required as a circuit, and an unnecessary part by performing laser processing as opposed to this copper thin film, and galvanizing only into a part required as a circuit by electroplating When the electric conduction metal layer 12 which constitutes a circuit pattern is formed, the copper thin film of the part used as opening 13 at the time of processing to the above-mentioned copper thin film is removed. Since the electric conduction metal layer 12 is not formed in a removal part, it will remain as opening 13. In addition, after forming the electric conduction metal layer 12 in the whole front face of a projected part 11, opening 13 may be formed by removing by laser, when considering as the opening 13 in the electric conduction metal layer 12.
[0030] Another example is shown in drawing 8 . The projected part 11 is made easy to deform by vacating a hole 15 for the side face of the projected part 11 formed in a base material 10 and one here. This hole 15 can be formed by laser processing or micro drilling, and it can consider as the bump 2 who is very easy to deform by vacating a hole 15, after forming especially the electric conduction metal layer 12.
[0031] Moreover, if it hits vacating a hole 15, a bump 2 shall be transformed with sufficient balance by forming in the symmetry to the center line of a projected part 11. Moreover, if it is made for a hole 15 to penetrate a projected part 11 as shown in drawing 9 , what is further easy to deform can be obtained.
[0032] As shown in drawing 10 , the lobe 16 which floated from base material 10 front face is formed in a part of conductive metal layer 12 formed in the front face of a base material 10, and it is good for it also considering this lobe 16 as a bump 2. Since the bump 2 is hollow, she can deform easily by the pressurization by the time of mounting of IC2, and can absorb dispersion in height.
[0033] The above-mentioned lobe 16 can be formed as follows. For example, pressing down the perimeter of the part made into a lobe 16 with a mold 18, after forming the electric conduction metal layer 12 in the front face of a base material 10, as shown in drawing 11 , the place made into a lobe 16 is attracted and it floats from a base material 10. As shown in drawing 12 , a lobe 16 may be formed by making the electric conduction metal layer 12 the hole prepared in the base material 10 from a rear-face side through a bar 9. If the release agent 8 is made to intervene between the electric conduction metal layer 12 and a base material 10 at the place made into a lobe 16 as shown in drawing 13 in any case, it will become easy from a base material 10 to float the electric conduction metal layer 12.
[0034] In addition, as shown in drawing 14 , after forming the projected part 11 which consists of a low-melt point point ingredient 6 in the front face of a base material 10, you may make it form the bump 2 in the air who consists only of an electric conduction metal layer 12 by covering the front face of this projected part 11 with the electric conduction metal layer 12, and sucking out, where melting of the above-mentioned low-melt point point ingredient 6 is heated and carried out after that. What is necessary is just to perform the above-mentioned extrusion from the hole 17 and opening which were prepared in the top face or side face of the electric conduction metal layer 12 of a bump 2. Since the rigidity of the electric conduction metal layer 12 can be reduced when said opening 13 is formed in a side face, the bump 2 who is further easy to deform can be obtained. It may replace with the low-melt point point ingredient which can use paraffin suitably as a low-melt point point ingredient, and a projected part 11 may be formed with the ingredient which dissolves with a specific chemical.
[0035] It has formed the hole 17 in the part which has covered the apical surface of the projected part

11 in the electric conduction metal layer 12 while drawing 15 shows other examples further, forms a projected part 11 with the solder which is the low-melt point point ingredient 6 here and covers the front face of this projected part 11 with the electric conduction metal layer 12.
[0036] If IC3 is carried on the bump 2 of this substrate 1 and heating pressurization is carried out, the solder in a bump 2 will be fused, it will extrude besides the electric conduction metal layer 12 from a hole 17, the electric conduction metal layer 12 and the terminal area 30 of IC3 will be wet, and solder will perform junction to the electric conduction metal layer 12 and the terminal area of IC3 by subsequent cooling.
[0037] In this case, if the slot 19 which follows a hole 17 is formed as shown in the front face of the part which has covered the apical surface of the projected part 11 in the electric conduction metal layer 12 at drawing 16 , since it will become the passage of the melting solder with which the slot 19 was extruded, it becomes easy to come out of solder, and required welding pressure is small and ends.
[0038] By the way, as the bump 2 of the above-mentioned hollow is also shown in drawing 16 , as for forming opening 13, it is needless to say that it is effective. Moreover, as a bump's 2 configuration, although many things of a truncated truncated-cone configuration were shown, you may be a truncated truncated-pyramid configuration, a boiled-fish-paste mold configuration, etc., and it is not limited to the configuration of the example of illustration.
[0039]
[Effect of the Invention] Dispersion in a bump's height can be absorbed as welding pressure required at the time of mounting of IC is small since the above-mentioned projected part is formed with the ingredient softer than a base material while covering the projected part front face prepared on the surface of the base material in this invention in a conductive metal layer and forming a bump, as mentioned above, positive connection can be made, and it becomes, without giving a damage to IC.
[0040] In this case, the above-mentioned projected part can prepare the projected part from which an ingredient differs easily [a base material front face] by it having been formed as another member to the base material, and having been inserted in the base material.
[0041] Moreover, since this invention has prepared opening which exposes a projected part side face for a projected part front face in a wrap electric conduction metal layer while it covers the projected part front face prepared on the surface of the base material in a conductive metal layer and forms a bump, it can reduce greatly the effect of rigid of an electric-conduction metal layer, consequently can absorb dispersion in a bump's height as welding pressure required at the time of mounting of IC is small, and can make positive connection.
[0042] The above-mentioned opening has what was formed as two or more flutings, and a desirable mesh-like thing in respect of the ease of deformation etc. Moreover, opening can make good deformation of balance able to perform by making and forming a symmetry configuration in the peripheral surface of a projected part, and can keep good the contact condition of a bump and the terminal area of IC.
[0043] Since the hole is furthermore vacated for the side face of the projected part covered in the electric conduction metal layer while this invention covers the projected part front face prepared on the surface of the base material in a conductive metal layer and forming a bump, a projected part can make small welding pressure required to be easy to deform, and have become, for this reason absorb dispersion in a bump's height.
[0044] It is avoidable that the hole in this case causes the situation which distorts and deforms a projected part by forming in the symmetry to the core of a projected part.
[0045] Moreover, since this invention makes the bump the lobe which floated from the base material front face of this electric conduction metal layer while forming a conductive metal layer on the surface of a base material, the bump is hollow, can deform easily and can make small welding pressure required to absorb [for this reason] dispersion in a bump's height.
[0046] Moreover, while this invention covers the projected part front face made from solder prepared on the surface of the base material in a conductive metal layer and forms a bump Since the stoma is formed in the part which has covered the apical surface of the above-mentioned projected part in an electric conduction metal layer The solder which can extrude solder besides a bump by heating pressurization at the time of mounting of IC, can acquire upwards the same effectiveness as

the case where a bump is formed as a thing in the air on parenchyma, and was extruded can be used for junction of IC.

[0047] In this case, if the slot which follows a stoma is formed in the front face of the part which has covered the apical surface of the projected part in an electric conduction metal layer, welding pressure required for solder's becoming easy to flow out outside by the heating pressurization in the case of mounting of IC, consequently making a bump transform can be made small.

[0048] And the substrate for IC mounting equipped with the bump of the above-mentioned hollow Form a conductive metal layer on the surface of a base material, and form the projected part as a bump by attracting a part of conductive metal layer subsequently, and floating from a base material front face, or Form a conductive metal layer on the surface of a base material, and form the projected part as a bump by pushing up from a rear-face side and floating from a base material front face by the bar which it let pass to the hole which, subsequently to a base material, prepared a part of conductive metal layer, or After preparing the projected part which furthermore consists of a low-melt point point ingredient on the surface of a base material, it can manufacture easily by covering the front face of this projected part with an electric conduction metal layer, carrying out melting of the above-mentioned low-melt point point ingredient with heating subsequently, and sucking out. When sucking out a low-melt point point ingredient especially later, the bump of a predetermined configuration can be formed certainly.

[0049] Moreover, in mounting of IC to the substrate for IC mounting equipped with the bump who dedicated solder to the interior By extruding besides an electric conduction metal layer from a stoma, while carrying out melting of the above-mentioned solder by carrying IC on a bump and carrying out heating pressurization, and joining an electric conduction metal layer and the terminal area of IC with this solder In addition to absorption of dispersion in a bump's height, it can join by solder exactly and junction dependability can be raised.

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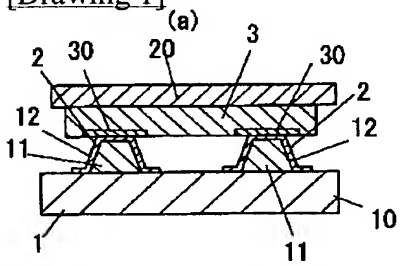
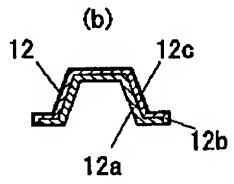
DRAWINGS

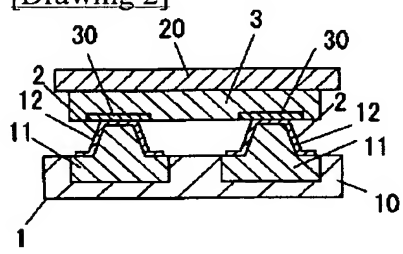
[Drawing 1]





1 基板
2 バンプ
3 IC
10 基材
11 突部
12 導電金属層

[Drawing 2]



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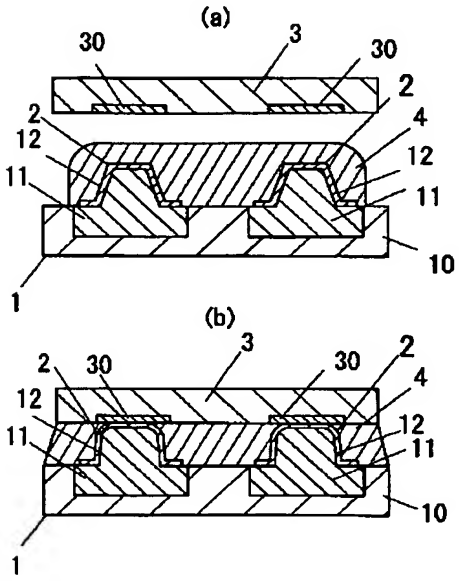

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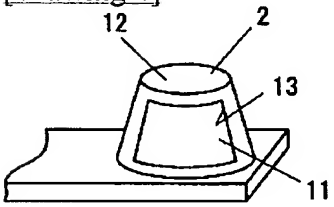
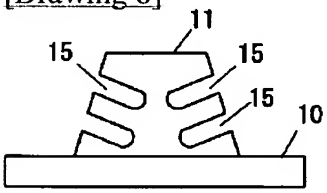


[Drawing 8]



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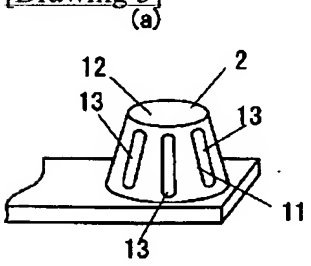
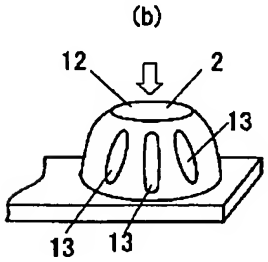
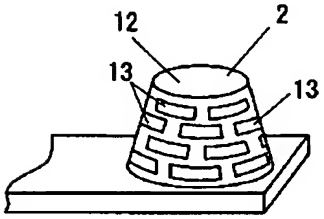


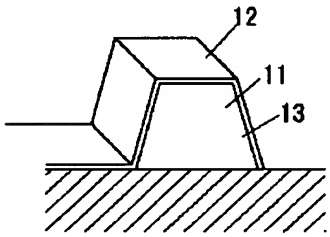


[Drawing 6]

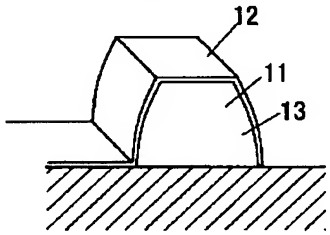


[Drawing 7]

(a)

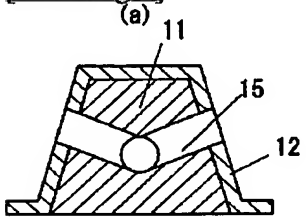


(b)

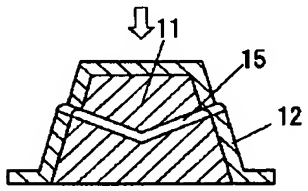


[Drawing 9]

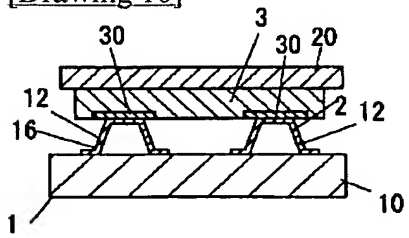
(a)



(b)



[Drawing 10]



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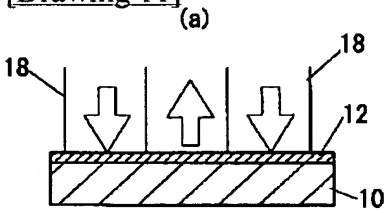
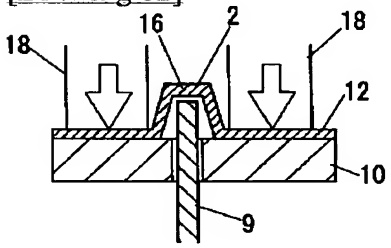
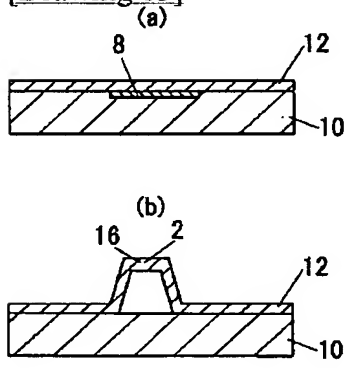


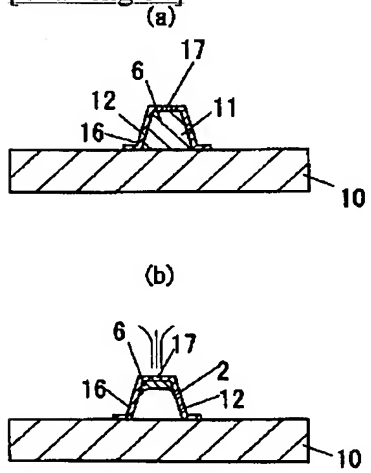
[Drawing 12]



[Drawing 13]

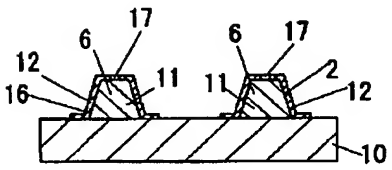


[Drawing 14]



 [Drawing 15]

(a)



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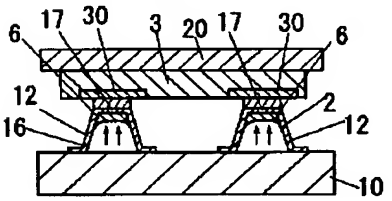
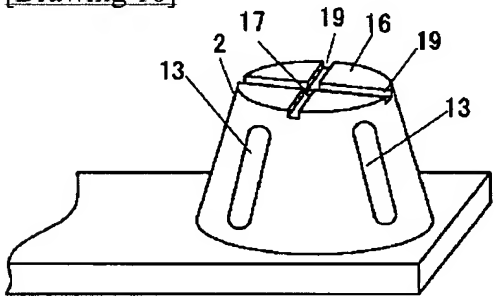


[Drawing 16]



[Translation done.]

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Ｈ０１Ｌ　21/60	３１１	Ｈ０１Ｌ　21/60	３１１Ｓ　５Ｆ０４４

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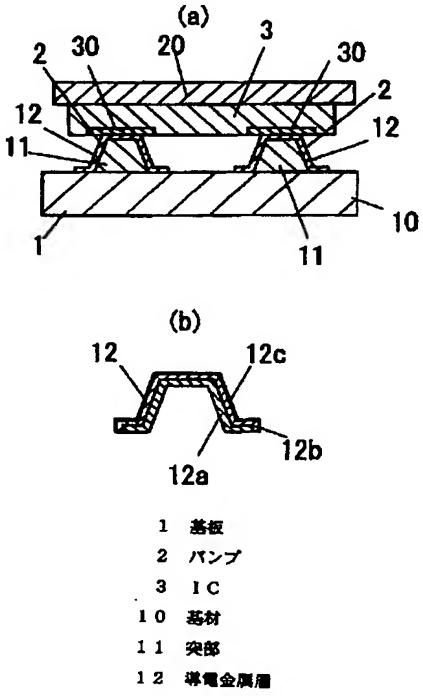
最終頁に続く

(54)【発明の名称】　ＩＣ実装用基板とその製造方法及びＩＣ実装用基板へのＩＣ実装方法

(57)【要約】
【課題】　ＩＣ実装を簡便に且つ高い信頼性のもとに行うことができるものとする。
【解決手段】　基材１０の表面に設けた突部１１表面を回路パターンとなる導電性金属層１２で覆ってＩＣ実装用端子部であるバンプ２を形成する。上記突部１１を基材１０よりも柔らかい材料で形成する。ＩＣ３の実装時に必要な加圧力が小さくともバンプ２の高さのばらつきを吸収して確実な接続を行うことができる。



1　基板
2　バンプ
3　ＩＣ
１０　基材
１１　突部
１２　導電金属層

1

【特許請求の範囲】

【請求項１】　基材の表面に設けた突部表面を回路パターンとなる導電性金属層で覆ってＩＣ実装用端子部であるバンプを形成するとともに、上記突部を基材よりも柔らかい材料で形成していることを特徴とするＩＣ実装用基板。

【請求項２】　突部は基材に対して別部材として形成されて基材に嵌め込まれたものであることを特徴とする請求項１記載のＩＣ実装用基板。

【請求項３】　基材の表面に設けた突部表面を回路パターンとなる導電性金属層で覆ってＩＣ実装用端子部であるバンプを形成するとともに、突部表面を覆う導電金属層に突部側面を露出させる開口部を設けていることを特徴とするＩＣ実装用基板。

【請求項４】　開口部は複数個の縦溝として形成されていることを特徴とする請求項３記載のＩＣ実装用基板。

【請求項５】　開口部はメッシュ状のものであることを特徴とする請求項３記載のＩＣ実装用基板。

【請求項６】　開口部は突部の周面に対称形状をなして形成されていることを特徴とする請求項３～５のいずれかの項に記載のＩＣ実装用基板。

【請求項７】　基材の表面に設けた突部表面を回路パターンとなる導電性金属層で覆ってＩＣ実装用端子部であるバンプを形成するとともに、導電金属層で覆われた突部はその側面に孔が空けられていることを特徴とするＩＣ実装用基板。

【請求項８】　孔は突部の中心線に対して対称に形成されていることを特徴とする請求項７記載のＩＣ実装用基板。

【請求項９】　基材の表面に回路パターンとなる導電性金属層を形成するとともに該導電金属層の基材表面から浮かせた突出部をＩＣ実装用端子部であるバンプとしていることを特徴とするＩＣ実装用基板。

【請求項１０】　基材の表面に設けた半田製の突部表面を回路パターンとなる導電性金属層で覆ってＩＣ実装端子部であるバンプを形成するとともに、導電金属層における上記突部の先端面を覆っている部分に小孔を形成していることを特徴とするＩＣ実装用基板。

【請求項１１】　導電金属層における突部の先端面を覆っている部分の表面に小孔に連続する溝を形成していることを特徴とする請求項１０記載のＩＣ実装用基板。

【請求項１２】　基材の表面に回路パターンを構成する導電性金属層を形成し、次いで導電性金属層の一部を吸引して基材表面から浮かせることでＩＣ実装用端子部であるバンプとしての突部を形成することを特徴とするＩＣ実装用基板の製造方法。

【請求項１３】　基材の表面に回路パターンを構成する導電性金属層を形成し、次いで導電性金属層の一部を基材に設けた孔に通した棒材で裏面側から押し上げて基材表面から浮かせることでＩＣ実装用端子部であるバンプとしての突部を形成することを特徴とするＩＣ実装用基板の製造方法。

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【請求項１４】　基材の表面に低融点材料からなる突部を設けた後、該突部の表面を回路パターンとなる導電金属層で被覆し、次いで上記低融点材料を加熱により溶融させて吸い出すことで、ＩＣ実装用端子部であるバンプとしての突部を形成することを特徴とするＩＣ実装用基板の製造方法。

【請求項１５】　基材の表面に設けた半田製の突部表面を回路パターンとなる導電性金属層で覆ってＩＣ実装用端子部であるバンプを形成するとともに、導電金属層における上記突部の先端面を覆っている部分に小孔を形成しているＩＣ実装用基板に対し、バンプ上にＩＣを載せて加熱加圧することで上記半田を溶融させるとともに小孔から導電金属層の外に押し出し、該半田で導電金属層とＩＣの端子部とを接合することを特徴とするＩＣ実装用基板へのＩＣの実装方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明はＩＣを直接実装するためのＩＣ実装用基板に関するものである。

【０００２】

【従来の技術】ＩＣの実装用の基板として、特開昭６３－２２０５３３号公報には基板の基材表面に突部を設けて該突部表面に導電金属層を形成することでバンプとし、該バンプに導電ペーストを介してＩＣを載せて加熱することで上記バンプにＩＣの端子部を接合するものが示されている。

【０００３】また、特表平９－５１１８７３号公報には、ポリマー樹脂からなる立体成形回路基板（ＭＩＤ基板）の成形時に突部を同時に成形して、突部表面に回路パターンを構成する導電性金属層を形成することでＩＣ実装用の端子部であるバンプとすることが開示されている。

【０００４】上記のように形成されたバンプを備えるＩＣ実装用基板は、ＩＣ側に半田バンプを設けなくともＩＣの実装が可能であるが、バンプの高さが揃っていないと接続不良を招くことになる。一方で、基板上の突部は、金型の寸法精度や金型から成形品への転写性などの影響で、各バンプの上面高さには約数μｍのばらつきが生じてしまう上に、基板の成形後の反りなどで約１０μｍ程度のばらつきが生じてしまう。

【０００５】この時、ＩＣ実装時の加圧力を利用すれば基板の反りの矯正を行うことができ、しかもバンプそのものが弾性を有する構成となっておれば、高さの違いも吸収することができることになり、接続不良の発生を低減させることができる。特に、上記のポリマー樹脂からなる立体成形回路基板の場合、突部を基板の成形時に同時に形成することができる上に、ポリマー樹脂製の突部は弾性を有することから、この点においても都合が良

い。

【０００６】

【発明が解決しようとする課題】しかし、高集積化が進むＩＣの端子数は数十～数百となっており、これに対応する数のバンプにＩＣを介して同時に力を加えようとすれば、総加圧力はかなり大きな値となるためにＩＣや基板の負担が大きくなりすぎて損傷が生じるおそれがある上に、加圧力の不十分な端子に加圧力を加えようとすれば、他の端子に適正以上の加圧力が加わることになる。そして、長期使用時に熱影響などで劣化が早まりやすく、クラックなどの損傷が生じやすくなり、電気接続信頼性に問題が生じる。

【０００７】もちろん、各バンプをきわめて弾性に富んだものとすることで総加圧力を小さくすることができると同時に、高さの違うバンプにかかる圧力の差を小さくすることができるが、このような特性を持つ材料で基材を形成することで基材が備える突部に所要の弾性を与えた場合、基材そのものに求められる特性を満足させることができなくなる。

【０００８】また、バンプにおける導電性金属層の下にある突部が十分弾性に富んだものとなっていても、導電性金属層がたとえば銅層とニッケル層と金層の３層からなる場合、ニッケル層の存在により導電金属層がかなり硬いものとなっており、突部が持つ弾性を活かすことができない。

【０００９】本発明はこのような点に鑑みなされたものであって、その目的とするところはＩＣ実装を簡便に且つ高い信頼性のもとに行うことができるＩＣ実装用基板とこのＩＣ実装用基板の製造方法、そして該ＩＣ実装用基板へのＩＣの実装を簡便に行うことができるＩＣ実装用基板へのＩＣ実装方法を提供するにある。

【００１０】

【課題を解決するための手段】しかして本発明にかかるＩＣ実装用基板は、基材の表面に設けた突部表面を回路パターンとなる導電性金属層で覆ってＩＣ実装用端子部であるバンプを形成するとともに、上記突部を基材よりも柔らかい材料で形成していることに第１の特徴を有している。

【００１１】この場合、上記突部は基材に対して別部材として形成されて基材に嵌め込まれたものを好適に用いることができる。

【００１２】また、本発明にかかるＩＣ実装用基板は、基材の表面に設けた突部表面を回路パターンとなる導電性金属層で覆ってＩＣ実装用端子部であるバンプを形成するとともに、突部表面を覆う導電金属層に突部側面を露出させる開口部を設けていることに第２の特徴を有している。

【００１３】ここにおける開口部は複数個の縦溝として形成されたものやメッシュ状のものが好適であるが、いずれの場合においても、開口部は突部の周面に対称形状をなして形成しておくことが望ましい。

【００１４】さらに本発明にかかるＩＣ実装用基板は、基材の表面に設けた突部表面を回路パターンとなる導電性金属層で覆ってＩＣ実装用端子部であるバンプを形成するとともに、導電金属層で覆われた突部はその側面に孔が空けられていることに第３の特徴を有している。

【００１５】この場合の孔は突部の中心線に対して対称に形成しておくことが望ましい。

【００１６】また本発明にかかるＩＣ実装用基板は、基材の表面に回路パターンとなる導電性金属層を形成するとともに該導電金属層の基材表面から浮かせた突出部をＩＣ実装用端子部であるバンプとしていることに第４の特徴を有している。

【００１７】また本発明にかかるＩＣ実装用基板は、基材の表面に設けた半田製の突部表面を回路パターンとなる導電性金属層で覆ってＩＣ実装用端子部であるバンプを形成するとともに、導電金属層における上記突部の先端面を覆っている部分に小孔を形成していることに第５の特徴を有している。

【００１８】この場合、導電金属層における突部の先端面を覆っている部分の表面に小孔に連続する溝を形成しておくとよい。

【００１９】そして、上記第４の特徴を備えたＩＣ実装用基板の製造方法としては、基材の表面に回路パターンを構成する導電性金属層を形成し、次いで導電性金属層の一部を吸引して基材表面から浮かせることでＩＣ実装用端子部であるバンプとしての突部を形成したり、基材の表面に導電性金属層を形成し、次いで導電性金属層の一部を基材に設けた孔に通した棒材で裏面側から押し上げて基材表面から浮かせることでバンプとしての突部を形成したり、さらには基材の表面に低融点材料からなる突部を設けた後、該突部の表面を導電金属層で被覆し、次いで上記低融点材料を加熱により溶融させて吸い出すことで、バンプとしての突部を形成するのが好ましい。

【００２０】また、上記第５の特徴を備えたＩＣ実装用基板へのＩＣの実装にあたっては、バンプ上にＩＣを載せて加熱加圧することで上記半田を溶融させるとともに小孔から導電金属層の外に押し出し、該半田で導電金属層とＩＣの端子部とを接合するとよい。

【００２１】

【発明の実施の形態】以下本発明を実施の形態の一例に基づいて詳述すると、図１は本発明にかかるＩＣ実装用基板１の概略構成を示しており、基材１０の表面に複数（多数）の突部１１を設けているとともに、突部１１の表面を回路パターンを構成している導電金属層１２で被覆して、ＩＣの実装用端子部であるバンプ２を形成している。図中２０はＩＣ実装時の加圧用の治具である。

【００２２】ここにおける基材１０は、図では平板状のもので示しているが、立体成形回路基板（ＭＩＤ基板）として形成されるものを好適に用いることができる。な

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お、突部１１は幅が１００μｍ程度、高さが１００μｍ程度のものであり、めっきで形成されて回路パターンを構成している導電金属層１２は、５～１０μｍ程度厚の銅めっき１２ａ上に５～１０μｍ程度厚のニッケルめっき１２ｂを施し、さらにこの上に０．３～０．５μｍ厚程度の金めっき１２ｃを施すことで形成してある。

【００２３】そして、上記基材１０と突部１１とは異なる材料で形成されており、基材１０よりも突部１１の方が弾性に富んだ柔らかい材料で形成されている。立体成形回路基板の場合を例にとれば、基材１０はポリフタルアミド樹脂（弾性率５～１０ＧＰａ）で、突部１１はフッ素樹脂（弾性率０．１～１ＧＰａ）で形成され、例えば２色成形（２回成形）によって、基材１０上に突部１１を設けている。この時、複数の突部１１が個々に独立していなくてもよく、突部１１と同一材料で基材１０の表面上に突部１１間をつなぐ接続層を形成していてもよい。

【００２４】また、図２に示すように、突部１１を基材１０とは別部品として成形した後、基材１０に嵌め込んで取り付けた後、導電金属層１２を形成するようにしてもよい。突部１１の基材１０への固定は、圧入や接着、両者の併用などで行う。この場合においても、複数の突部１１を一体に成形した突部ブロックを形成し、該突部ブロックを基材１０に嵌め込んで固定するのが好ましい。

【００２５】いずれにしても、突部１１は基材１０よりも柔らかい材料で形成していることから、バンプ２にＩＣ３の端子部３０を載せて接続することでＩＣ３の実装を行うにあたり、基材１０は硬くともバンプ２は加圧によって容易に弾性変形して高さのばらつきを吸収することから、ＩＣ３に過大な負荷がかかることはない。

【００２６】なお、ＩＣ３の実装にあたっては、図３に示すように、基板１上にアンダーフィル４を塗布した後、ＩＣ３の加熱加圧による実装と該加熱によるアンダーフィル４の硬化とを行い、アンダーフィル４によって突部１１の弾発力に抗した固定力を得るようにするほか、バンプ２にＩＣ３の端子部３０を載せた状態でＩＣ３側から超音波を加えることで、バンプ２の導電金属層１２における最上層の金とＩＣ３の端子部３０のアルミニウムとを金属接合させ、この後にアンダーフィル４をＩＣ３と基板１との間に流し込んで硬化させるようにしてもよい。

【００２７】図４に他例を示す。これは突部１１の表面を覆っている導電金属層１２のうち、突部１１の側面に位置する部分に開口部１３を形成して突部１１側面を露出させたものである。この開口部１３の存在は、バンプ２を圧縮する方向における導電金属層１２の剛性を大きく低下させるために、ＩＣ３の実装時に低荷重でバンプ２が変形して高さのばらつきの吸収がなされることになる。

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【００２８】開口部１３は矩形状の窓型のほか、図５に示すように、等間隔で並ぶ複数個の縦溝型のものとしたり、図６に示すようなメッシュ形状としたり、更には図７に示すように複数個を対称位置に設ければ、ＩＣ２の実装時のバンプ２は均等に、あるいはバランス良く変形するために、導電金属層１２にクラックなどが生じてしまうことがない。この場合、突部１１が基材１０と別材料の柔らかいものでなくとも、バンプ２として所要の弾性を得ることができる。

【００２９】上記開口部１３は次のようにして形成する。すなわち、基材１０の表面に銅スパッタリング法によって銅薄膜を形成した後、該銅薄膜に対してたとえばレーザー加工を行うことで回路として必要な部分と不必要な部分とを分離し、電気めっきによって回路として必要な部分にのみめっきを施すことで、回路パターンを構成する導電金属層１２を形成している場合、上記銅薄膜に対する加工時に開口部１３とする部分の銅薄膜を除去しておくのである。除去部分には導電金属層１２が形成されないために、開口部１３として残ることになる。この他、突部１１の表面全体に導電金属層１２を形成した後、導電金属層１２における開口部１３とするところを例えばレーザーで除去することによって開口部１３を形成してもよい。

【００３０】図８に別の例を示す。ここでは基材１０と一体に形成された突部１１の側面に孔１５を空けることで、突部１１を変形しやすくしている。この孔１５はレーザー加工やマイクロドリリングによって形成することができ、特に導電金属層１２を形成した後に孔１５を空けることで、きわめて変形しやすいバンプ２とすることができる。

【００３１】また、孔１５を空けるにあたっては、突部１１の中心線に対して対称に形成することで、バンプ２をバランス良く変形するものとすることができる。また、図９に示すように、孔１５が突部１１を貫通するようにしておけば、さらに変形しやすいものを得ることができる。

【００３２】図１０に示すように、基材１０の表面に形成した導電性金属層１２の一部に基材１０表面から浮いた突出部１６を形成して、該突出部１６をバンプ２としてもよい。バンプ２は中空となっているために、ＩＣ２の実装時による加圧で容易に変形して、高さのばらつきを吸収することができる。

【００３３】上記突出部１６は、次のようにして形成することができる。たとえば図１１に示すように、基材１０の表面に導電金属層１２を形成した後、突出部１６とする部分の周囲を型１８で押さえつつ、突出部１６とするところを吸引して基材１０から浮かすのである。図１２に示すように、基材１０に設けた孔に棒材９を通して導電金属層１２を裏面側から押し上げることで突出部１６を形成してもよい。いずれの場合も、図１３に示すよ

うに、突出部１６とするところには導電金属層１２と基材１０との間に離型材８を介在させておくと、基材１０から導電金属層１２を浮かせることが容易となる。

【００３４】このほか、図１４に示すように、基材１０の表面に低融点材料６からなる突部１１を設けた後、該突部１１の表面を導電金属層１２で被覆し、その後、上記低融点材料６を加熱して溶融させた状態で吸い出すことにより、導電金属層１２だけからなる中空のバンプ２を形成するようにしてもよい。上記吸い出しは、バンプ２の導電金属層１２の上面あるいは側面に設けた孔１７や開口部から行えばよい。側面に前記開口部１３を設けた場合は、導電金属層１２の剛性を低下させることができるために、さらに変形しやすいバンプ２を得ることができる。低融点材料としてはパラフィンを好適に用いることができる、低融点材料に代えて、特定の薬品で溶解する材料で突部１１を形成してもよい。

【００３５】図１５は更に他例を示しており、ここでは低融点材料６である半田で突部１１を形成して、該突部１１の表面を導電金属層１２で被覆するとともに、導電金属層１２における突部１１の先端面を覆っている部分に孔１７を形成してある。

【００３６】この基板１のバンプ２上にＩＣ３を載せて加熱加圧すれば、バンプ２内の半田は溶融して孔１７から導電金属層１２の外に押し出されて導電金属層１２とＩＣ３の端子部３０とを濡らすものであり、その後の冷却で半田は導電金属層１２とＩＣ３の端子部との接合を行う。

【００３７】この場合、導電金属層１２における突部１１の先端面を覆っている部分の表面に図１６に示すように孔１７に連続する溝１９を形成しておけば、溝１９が押し出された溶融半田の流路となるために、半田が出やすくなって、必要な加圧力が小さくてすむものとなる。

【００３８】ところで、上記中空のバンプ２についても、図１６に示すように、開口部１３を設けることは有効であるのはもちろんである。また、バンプ２の形状として、裁頭円錐台形状のものを多く示したが、裁頭角錐台形状、蒲鉾型形状等であってもよく、図示例の形状に限定されるものではない。

【００３９】

【発明の効果】以上のように本発明においては、基材の表面に設けた突部表面を導電性金属層で覆ってバンプを形成するとともに、上記突部を基材よりも柔らかい材料で形成しているために、ＩＣの実装時に必要な加圧力が小さくともバンプの高さのばらつきを吸収して確実な接続を行うことができるものであり、ＩＣにダメージを与えてしまうこともなくなるものである。

【００４０】この場合、上記突部は基材に対して別部材として形成されて基材に嵌め込まれたものとすることで、材料の異なる突部を基材表面に簡単に設けることができる。

【００４１】また本発明は、基材の表面に設けた突部表面を導電性金属層で覆ってバンプを形成するとともに、突部表面を覆う導電金属層に突部側面を露出させる開口部を設けているために、導電金属層の剛性の影響を大きく低減させることができ、この結果、ＩＣの実装時に必要な加圧力が小さくともバンプの高さのばらつきを吸収して確実な接続を行うことができる。

【００４２】上記開口部は複数個の縦溝として形成されたものやメッシュ状のものが変形の容易さ等の点で好ましい。また、開口部は突部の周面に対称形状をなして形成しておくことでバランスの良い変形を行わせることができ、バンプとＩＣの端子部との接触状態を良好に保つことができる。

【００４３】さらに本発明は、基材の表面に設けた突部表面を導電性金属層で覆ってバンプを形成するとともに、導電金属層で覆われた突部の側面に孔を空けているために、突部は変形しやすくなっており、このためにバンプの高さのばらつきを吸収するのに必要な加圧力を小さくすることができる。

【００４４】この場合の孔は突部の中心に対して対称に形成しておくことで、突部がゆがんで変形してしまう事態を招くことを避けることができる。

【００４５】また本発明は、基材の表面に導電性金属層を形成するとともに該導電金属層の基材表面から浮かせた突出部をバンプとしているために、バンプは中空となっていて容易に変形するものであり、このためにバンプの高さのばらつきを吸収するのに必要な加圧力を小さくすることができる。

【００４６】また本発明は、基材の表面に設けた半田製の突部表面を導電性金属層で覆ってバンプを形成するとともに、導電金属層における上記突部の先端面を覆っている部分に小孔を形成しているために、ＩＣの実装時の加熱加圧によって半田をバンプ外に押し出すことができるものであり、実質上、バンプを中空のものとして形成した場合と同様の効果を得ることができる上に、押し出した半田はＩＣの接合に用いることができる。

【００４７】この場合、導電金属層における突部の先端面を覆っている部分の表面に小孔に連続する溝を形成しておくと、ＩＣの実装の際の加熱加圧で半田は外部に流れ出やすくなり、この結果、バンプを変形させるのに必要な加圧力を小さくすることができる。

【００４８】そして、上記中空のバンプを備えたＩＣ実装用基板は、基材の表面に導電性金属層を形成し、次いで導電性金属層の一部を吸引して基材表面から浮かせることでバンプとしての突部を形成したり、基材の表面に導電性金属層を形成し、次いで導電性金属層の一部を基材に設けた孔に通した棒材で裏面側から押し上げて基材表面から浮かせることでバンプとしての突部を形成したり、さらには基材の表面に低融点材料からなる突部を設けた後、該突部の表面を導電金属層で被覆し、次いで上

記低融点材料を加熱により溶融させて吸い出すことで、容易に製造することができる。ことに低融点材料を後で吸い出す場合、所定の形状のバンプを確実に形成することができる。

【００４９】また、半田を内部に納めたバンプを備えたＩＣ実装用基板へのＩＣの実装にあたっては、バンプ上にＩＣを載せて加熱加圧することで上記半田を溶融させるとともに小孔から導電金属層の外に押し出し、該半田で導電金属層とＩＣの端子部とを接合することで、バンプの高さのばらつきの吸収に加えて、半田接合を的確に行うことができ、接合信頼性を高めることができる。

【図面の簡単な説明】

【図１】本発明の実施の形態の一例を示すもので、(a)は断面図、(b)は導電金属層の拡大断面図である。

【図２】同上の他例の断面図である。

【図３】同上のＩＣ実装手順を示すもので、(a)(b)は共に断面図である。

【図４】さらに他例のバンプの斜視図である。

【図５】同上の他例を示すもので、(a)は加圧前の斜視図、(b)は加圧後の斜視図である。

【図６】同上のさらに他例を示す斜視図である。

【図７】同上の別の例を示すもので、(a)は加圧前の斜視図、(b)は加圧後の斜視図である。

【図８】他の例の断面図である。

【図９】同上の他例を示すもので、(a)は加圧前の断面図、(b)は加圧後の断面図である。

【図１０】更に他の例の断面図である。

【図１１】同上のバンプの形成手順を示すもので、(a)(b)は断面図である。

【図１２】同上のバンプの他の形成手順を示す断面図である。

【図１３】同上の他の例を示すもので、(a)(b)は断面図である。

【図１４】同上のバンプのさらに他の形成手順を示すもので、(a)(b)は断面図である。

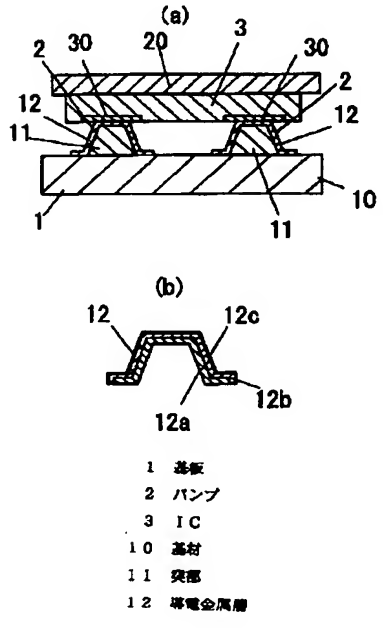
【図１５】別の例を示すもので、(a)(b)は断面図である。

【図１６】同上の他の例におけるバンプの斜視図である。

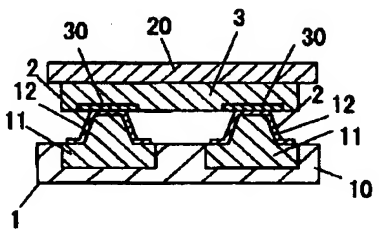
【符号の説明】

１　基板
２　バンプ
３　ＩＣ
１０　基材
１１　突部
１２　導電金属層

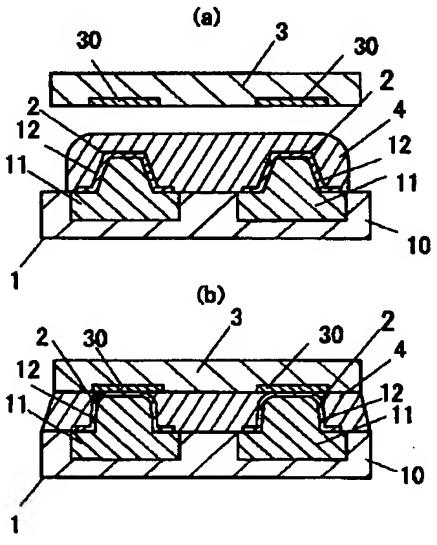
【図１】



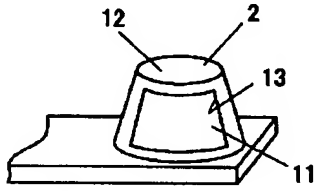
【図２】



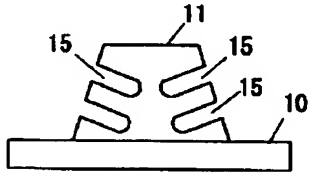
【図３】



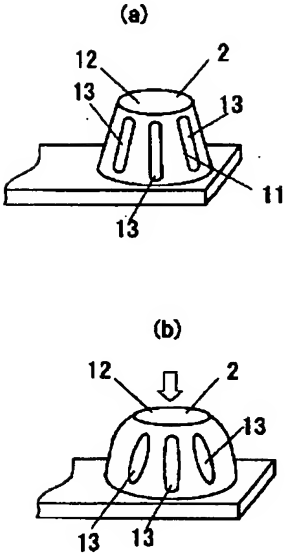
【図４】



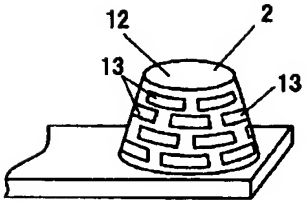
【図８】



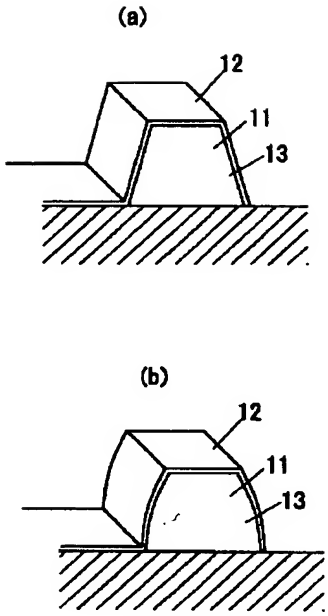
【図５】



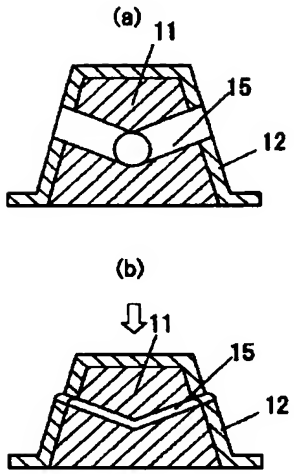
【図６】



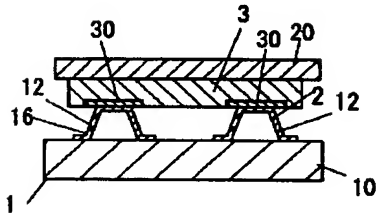
【図７】



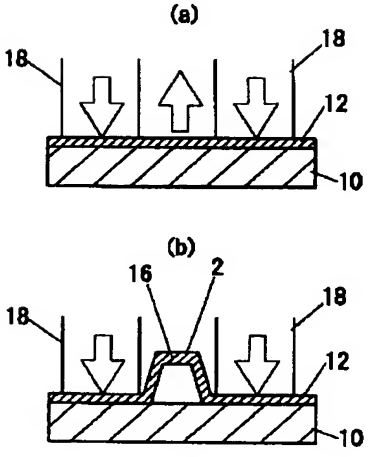
【図９】



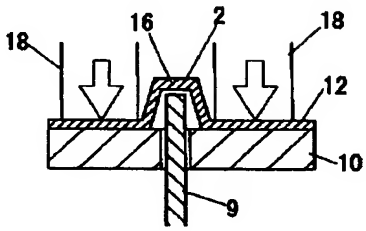
【図１０】



【図１１】



【図１２】



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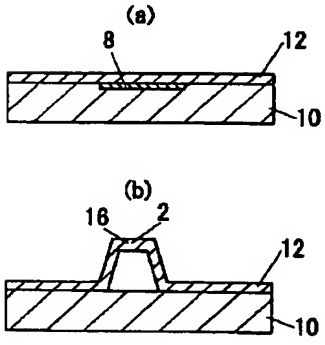

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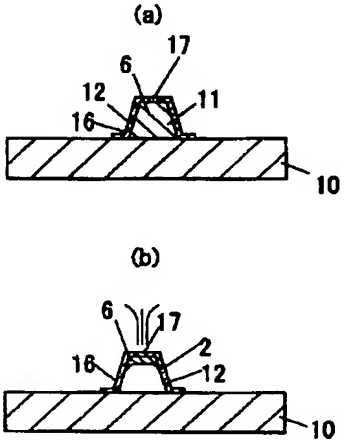

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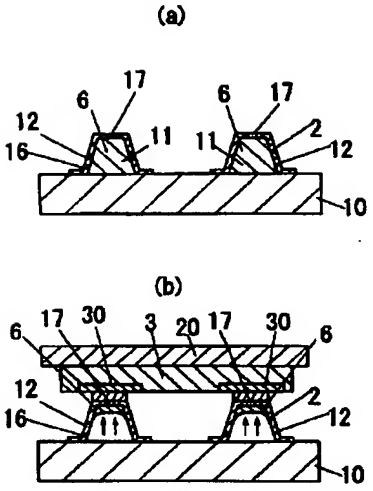

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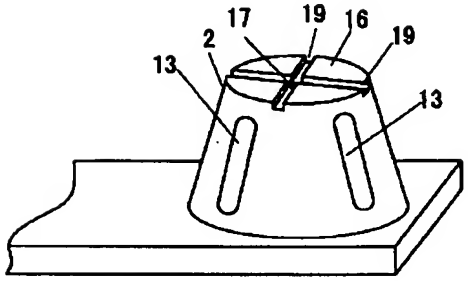

フロントページの続き

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